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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/970,071	10/03/2001	John F. Ranta	B-26	9065

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EXAMINER	
SAADAT, CAMERON	
ART UNIT	PAPER NUMBER
3714	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	02/20/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	09/970,071	RANTA ET AL.	
	Examiner	Art Unit	
	Cameron Saadat	3714	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 August 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-19 and 22-32* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-19,22-25 and 29-32* is/are rejected.

7)☒ Claim(s) *26-28* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

In response to amendment filed 1/8/2006 and supplemental amendment filed 8/24/2006, claims 1-19 and 22-32 are pending in this application. Claims 20-21 are cancelled.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1, 9-12, and 15-19, 22-25, 29-32 rejected under 35 U.S.C. 103(a) as being unpatentable over Arnold – *Virtual Teeth for Endodontics Training and Practice* in view of Tarr (USPN 6,191,796 B1), further in view of NASA Tech Briefs – *Haptic Technologies' PenCAT/Pro 3D pen.*

Regarding claims 1 and 19, Arnold discloses a method and apparatus for simulating dental procedures for training dental students comprising, the steps of: storing volumetric data defining the location of an isosurface in a model of a tooth; (as per claim 19) storing volume elements in three-dimensional space (See P. 599 ¶ 4 – P. 600); employing a digital computer consisting of a processor and a display device to display a model of the tooth; employing the digital computer and display device to display a model of a dental tool; and employing a haptic interface device including the PenCat force-

feedback device (manufactured by Haptic Technologies Inc.) that is manually moveable by a dental student and coupled to the digital computer to move the model of a dental tool with respect to the model of a tooth (P. 600 ¶ 5 – P. 602); and employing the processor to compare the location of an isosurface in the tooth model with positions of at least one feel point that models the surface of a dental tool to calculate and apply computer-controlled interaction forces to the PenCat force feedback device to simulate the feel of the dental tool to haptically simulate a dental procedure (See Abstract, lines 14-21; P. 601; P. 603, ¶ 7). Arnold discloses all of the claimed subject matter with the exception of explicitly disclosing the feature of storing point data defining the positions of a *plurality of feel points that model the surface of the dental tool*. However, Arnold discloses techniques that involve combining surface descriptions with force feedback and collision detection, to give the dentist realistic sensations in simulating treatment procedures (see Abstract, lines 14-21). Therefore, it is the examiner's position that there must be *at least one point data* stored defining the position of a feel point that models the surface of the dental tool in order to detect a collision between the dental tool and a tooth model. In addition, Tarr discloses a method for haptically deforming a virtual surface in a virtual environment, wherein a haptic tool is modeled as a *plurality* of discrete points in order to form the volumetric shape of the tool (Col. 5, lines 41-46). Thus, in view of Tarr, it would be obvious to one of ordinary skill in the art to modify the collision detection described in Arnold, by storing point data defining the positions of a *plurality of feel points that model the surface of a tool*, in order to form a volumetric shape of the tool, and thereby accurately detect collision between the tool and a virtual object for providing haptic feedback for training physicians and surgeons (See Tarr, Col. 2, lines 10-34).

In addition, Arnold does not explicitly disclose that the PenCat force feedback device includes a *stylus*. However, NASA Tech Briefs teaches that the Haptic Technologies' PenCat device includes a stylus (See Photo). Thus, it would have been obvious to one of ordinary skill in the art to utilize the same PenCat stylus described in NASA Tech Briefs as suggested in Arnold, in order to provide a haptic device that simulates a dental instrument for providing training in dental procedures (Arnold, P. 603, ¶ 7).

Regarding claim 9, Arnold discloses a simulated dental procedure wherein the display device renders the model of a tooth and the model of a dental tool in a three dimensional display (P. 598 ¶ 3.1-3.2; P. 603, conclusion). Arnold does not explicitly disclose the use of a stereoscopic display. However, it is the examiner's position that the use of stereoscopic displays is old and well know in virtual reality environments for providing the impression of depth and thereby providing a more realistic simulation. Thus, it would have been obvious to an artisan to modify the three dimensional display described in Arnold, by providing a stereoscopic display in order to provide a more realistic virtual reality environment.

Regarding claim 10, Arnold discloses a simulated dental procedure comprising a haptic interface device that is manually moveable by a dental student includes a moveable hand piece that is moveable in at least three degrees of freedom (P 601, top of page).

Regarding claim 11, Arnold discloses a simulated dental procedure wherein the display device renders the model of a tooth volumetrically as a solid object consisting of a collection of volume elements (See P. 599, ¶ 4 - 4.2).

Regarding claim 12, Arnold discloses a simulated dental procedure wherein said model of a tooth is subdivided into different regions simulating different materials of a tooth, including pulp tissue (P.597, ¶ 2) and root canals. Although implied, it is not explicitly stated that the different regions are specified by different material type data values. However, Tarr discloses a method for haptically deforming a virtual surface in a virtual environment, wherein a haptic tool collides with a virtual object; wherein the virtual object comprises various regions specified by different material types (Col. 5, lines 22-46). Hence, in view of Tarr, it would be obvious to one of ordinary skill in the art to modify the regions described in Arnold, by assigning different material type data values to the regions of a virtual object, in order to simulate elasticity of deformable surfaces when manipulated by a virtual tool.

Regarding claim 15, Arnold discloses a simulated dental procedure including a means for storing volumetric object grid data specifying the attributes of selected volume elements (See P. 599, ¶ 4 - 4.2).

Regarding claim 17, Arnold discloses a method for simulating dental procedures including the step of responding the movement of the model of a dental tool with respect to the model of a tooth by modifying volumetric object grid data (See P 601).

Regarding claims 18 and 22-23, Arnold discloses a method including a means for storing data for representing the shape and character of a modification region (collision detection) of the model of a dental tool to control the manner in which the volumetric object grid data is modified (See P. 601-602; P. 603, ¶ 7).

Regarding claim 24 Arnold discloses a method, wherein the simulation program increases interaction forces to the stylus when moved near a tooth (as per claim 24) as a user guides the simulated instrument through a root canal (See P. 603, ¶ 7).

Regarding claim 25, Arnold discloses a method for simulating dental procedures including a simulated dental tool comprising at least one feel point. Arnold does not explicitly disclose that the feel points define a handle portion of the tool. However, Tarr discloses a method for haptically deforming a virtual surface in a virtual environment, wherein a haptic tool is modeled as a *plurality* of discrete points in order to form the volumetric shape of the tool (Col. 5, lines 41-46). Thus, in view of Tarr, it would be obvious to one of ordinary skill in the art to modify the at least one feel point of the dental tool described in Arnold, by storing point data defining the positions of a *plurality of feel points that model the surface of the entire tool*, in order to form a volumetric shape of the tool, and thereby accurately detect collision between the tool and a virtual object for providing haptic feedback for training physicians and surgeons (See Tarr, Col. 2, lines 10-34).

Regarding claim 29, Arnold discloses a method wherein some of the feel points are positioned relative to a modification region to guide the movement of the modification region with respect to the tooth model (See P. 603, ¶ 7).

Regarding claims 30-32, Arnold discloses a method wherein tool definition data includes specification of location of sensor points relative to modification region for determining attributes of volume elements (P. 603-603).

Claims 2-8, 13-14, 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Arnold – *Virtual Teeth for Endodontics Training and Practice* in view of Tarr (USPN 6,191,796 B1), further in view of NASA Tech Briefs – *Haptic Technologies' PenCAT/Pro 3D pen*, still further in view of Hayka et al. (USPN 5,688,118; hereinafter Hayka).

Regarding claims 2-8, 13-14 Arnold discloses a system that simulates a dental tool for performing a root canal procedure (See P. 603, ¶ 7), which includes drilling and removing pulp tissue from canals, shaping, and sealing (P. 597, ¶ 2). Arnold does not explicitly disclose that the simulated dental tool is a pick (as per claim 2), drill (as per claims 3 and 13), amalgam carrier (as per claims 4 and 14), carver (as per claim 5), and combinations thereof (as per claims 6-8). However, it is the examiner's position that it would be obvious to one of ordinary skill in the art to simulate various dental tools required for specific dental operations. For instance, Hayka discloses a system that can be configured to simulate of various dental procedures such as cavity preparations, crown preparations, root canal preparations, and all other performances carried out by means of the dental hand piece and/or hand tools, including a chisel, an angle former, and enamel hatchet (Col. 12, lines 32-40). Hence, in view of Hayka, it would have been obvious to an artisan to modify the virtual tool described in the combination of Arnold and Tarr, by allowing configuration to simulate various dental tools in order to provide training for specific dental operations, such as a root canal.

Regarding claim 16, Arnold discloses a method for simulating dental procedures including the step of responding the movement of the model of a dental tool with respect to the model of a tooth by modifying volumetric object grid data (See P 601).

Allowable Subject Matter

Claims 26-28 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is an examiner's statement of reasons for allowance: The closest prior art of record does not teach or fairly suggest all or the claimed subject matter of independent claim 19 in combination with the features of (as per claim 26) positioning feel points outwardly from a modification region to increase the amount of force necessary to modify data representing a tooth; (as per claim 27) positioning feel points inwardly into a modification region to decrease the amount of force necessary to modify data representing a tooth; and (as per claim 28) positioning adjacent feel points spaced by a distance larger than the dimension of projecting portions of a tooth to facilitate the removal of the projecting portions.

Response to Arguments

Applicant's arguments filed 1/8/2006 have been fully considered but they are not persuasive.

Applicant purports that Arnold does not display a model of a dental tool and certainly does not display anything that could be said to be a "model of a tool having a handle" as claimed. The examiner respectfully disagrees. On page 603 of Arnold, the conclusion describes the following, "The new generation of 3D haptic feedback devices will be used so that the user can 'feel' as he sees the instrument being directed through the root canal." Thus, contrary to applicant's assertion, Arnold discloses the feature of displaying a model of a dental tool.

Applicant further emphasizes that none of the cited references disclose modeling the surface of a dental tool *having a handle*. The examiner disagrees. Arnold discloses the *PenCat* force feedback device for simulating force feedback and collision detection between a virtual tooth and a virtual instrument. It is noted that the PenCat is a force-feedback stylus that is manipulated by a trainee's hand and therefore simulates a virtual instrument having a handle.

It is the examiner's position that Arnold discloses all of the claimed subject matter with the exception of explicitly disclosing the feature of storing point data defining the positions of a *plurality of feel points that model the surface of the dental tool.* However, it is noted that Arnold does disclose techniques that involve combining surface descriptions with force feedback and collision detection, to give the dentist realistic sensations in simulating treatment procedures (see Abstract, lines 14-21). Therefore, it is the examiner's position that Arnold discloses *at least one point data* stored defining the position of a feel point that models the surface of the dental tool, in order to detect a collision between the dental tool and a tooth model. Accordingly, it would have been obvious to model the dental tool with a *plurality of feel points* in for the following reasons: Tarr discloses a method for haptically deforming a virtual surface in a virtual environment, wherein a haptic tool is modeled as a *plurality* of discrete points in order to form the volumetric shape of the tool (Col. 5, lines 41-46). Thus, in view of Tarr, it would be obvious to one of ordinary skill in the art to modify the collision detection described in Arnold, by storing point data defining the positions of a *plurality of feel points that model the surface of a tool*, in order to form a volumetric shape of the tool, and thereby accurately detect collision between the tool and a virtual object for providing haptic feedback for training physicians and surgeons (See Tarr, Col. 2, lines 10-34).

Applicant additionally asserts that there is nothing in the Hayka teaching that suggests that one could or should attempt to model a dental tool having a handle with a plurality of feel points to simulate the feel of a real tool as claimed. However, the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). In this case, the Hayka reference was not provided to teach all of the claimed features, but instead to show that it would have been obvious to one of ordinary skill in the art to modify the type of virtual tools described in the combination of Arnold and

Tarr, by allowing configuration to simulate various dental tools and procedures in order to provide training for specific dental operations, such as a root canal.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Cameron Saadat whose telephone number is (571) 272-4443. The examiner can normally be reached on M-F 9:00 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Robert Olszewski can be reached on (571) 272-6788. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer

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Cameron Saadat
February 13, 2007

2/14/07

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